

4.3.4 Line Stripping

Should the need arise to empty a major pipeline; it can be done utilizing the pumps located in Underground Pump House Valve. The fuel will be pumped from the pipeline into the appropriate tank at either the Upper Tank Farm or the Surge Tanks. As in all other fuel transfer operations, care must be taken to ensure that the valve line-up is properly completed and that the receipt tank has sufficient ullage to receive the product.

When ready to commence the stripping operation, the pump should be turned on, and a high point vent or header must be opened to allow air into the pipeline. Otherwise, the pump will draw a vacuum and not be able to remove any product from the line.

4.4 Tank Inspections

4.4.1 External Inspections

The exterior of all tanks will be inspected daily for obvious signs of spills and leaks.

4.4.2 Internal Inspections

Fuel storage tanks require internal tank inspections in accordance with MO-230. Bulk tanks will have the inspections conducted by an API 653 certified inspector. All shop fabricated tanks, including the two lube oil tanks require integrity inspections in accordance with Steel Tank Institute Standard SP001-03, —Standard for Inspection of In-Service Shop Fabricated Aboveground Tanks for Storage of Combustible and Flammable Liquids.

4.5 Tank Gauging

Gauging is a process of measuring height of a liquid in a storage tank usually using a weighted graduated steel tape and bob. This section describes the procedures to be followed to ensure accuracy in measuring the amount of fuel involved in all inventories, transfers, receipts and deliveries. Gauging is one of the most important operations in any transfer of products. It is the mechanical measurement of the product surface above the tank bottom, the depth of water on the tank bottom (water cut), and the product temperature.

Gauging a tank may be used to determine or verify:

- Present stock position
- Large product movements are proceeding according to plan
- Receipt or issue quantities
- The existence of leaks in tanks

The type of gauging most common and applicable for shore tanks is the innage gauge. The innage is the height of the liquid surface from the bottom of the tank. The innage is obtained by subtracting the measured distance between the surface of the liquid in the tank and the reference point from the official reference height of the tank.

Utmost care must be taken in securing accurate gauges and temperatures and in completing reports and records as required.

Only gauging tapes that have been checked by a supervisor shall be used. Turn in all faulty equipment to the supervisor for repair and/or replacement.

4.5.1 Determining the Total Volume in the Tank

To gauge a storage tank:

1. Select an innage tape and bob (innage bob is pointed).
2. Gauge all tanks from the reference gauge mark established at the top of the gauge hatch.
3. Check the overall height measurement (distance between gauge mark and bottom) as stenciled on tank and start the gauge tape into the tank in a careful manner.
4. Lower the bob slowly for the last several feet to the bottom to permit feeling the touch of the bob against the tank bottom. Lower the tape and bob into the tank until the tip of the bob barely touches the bottom of the tank.
5. If the gauge tape reading does not agree with the overall height within 1/8inch, raise the tape and lower to the bottom again.
6. If the difference continues to show, proceed to gauge by outage method and report difference in gauge book.
7. Retrieve the bob while observing where the tape becomes wet with fuel.
8. Wipe off fuel about six inches on either side of that point and note where that point is located.
9. Continue retrieving the tape while wiping off fuel and when water is present, apply a thin film of water-finding paste on the bob.
10. Lower bob into fuel until the point on the tape is reached where the tape became wet during previous gauging.
11. Apply a thin film of fuel-finding paste to the tape in a continuous strip about four inches above and below the expected product cut.
12. Lower the tape and bob into the tank until the tip of the bob barely touches the tank bottom.
13. Allow the tape and bob to remain in this position long enough for the fuel-finding and water-finding paste to react.
14. Reel in the tape to the oil mark, read to the nearest 1/8inch and record in gauge book.
15. Continue to reel tape in and read water gauge to nearest 1/8inch and record in gauge book.
16. Repeat gauging until at least two successive gauges show the same fuel cut and water cut.
17. Observe time to nearest minute and record in gauge book.
18. Close gauge hatch.

4.5.2 Gauging Red Hill Tanks

Due to the size of the tanks within the Red Hill Facility, a different process is required using ullage type gauging. Ullage is used to describe the empty space in large tanks. The ullage gauge is the distance from the surface of the product to a reference mark at the top of the tank. The following steps shall be followed while gauging Red Hill tanks:

1. Each Red Hill tank is slightly different, therefore, prior to conducting any gauging, the tank reference point (i.e. the distance from a set point in the gauging hatch to the bottom of the tank) must be known
2. Contact the control room and get the AFHE gauge (i.e. the amount of product in the tank according to the AFHE system)
3. Subtract the AFHE gauge distance from the reference point distance. This will indicate how deep the surface of the product within the tank should be
4. Apply a thin layer of fuel indicating paste to the bottom three feet of sounding tape
5. Lower sounding tape to the distance indicated by the AFHE plus two more feet and note that distance as the raw gauging depth
6. Use the length of discolored paste on the tape to determine how much of the tape was below the surface of the product (known as the "cut") and subtract that amount from the raw gauging depth. This will be the actual distance from the reference measurement point to the surface of the product. Subtract that from the reference point to determine the manual gauge of product.

7. Compare the manual gauging to the AFHE gauging. There must be no more than a 3/16th of an inch discrepancy between the two figures

4.5.3 Timing of Gauges

Gauges are taken as soon as possible after receipt or issue of product. However, sufficient time should be allowed for settling, air expulsion, etc., after deliveries to the tank. The tank should not be gauged when there is evidence of air expulsion (noted by air bubbles breaking at the surface of the product). If there is foam on the surface, the tank should be allowed to stand at least one hour to allow the product to settle before the closing gauge is taken. Extreme care must be exercised when handling low-flash products such as JP-8.

4.5.4 Static Electricity

Before gauging a tank, ground personnel must ground themselves and the gauge tape against any static electricity by touching some metallic portion of the tank, such as the handrail before opening the hatch. Always gauge a tank from the windward side of the hatch to prevent inhalation of vapors. Never gauge tanks during electrical storms and never wear any clothing such as nylon that will generate static electricity. Always keep the tape in contact with the metal edge of the gauging hatch until the bob is below the surface of the product.

4.5.5 Determining Bottom Sediment and Water (Water Cut)

From a quality and quantity standpoint, it is imperative that fuel be kept as water free as possible. Free water in fuel (especially jet fuel) causes erratic gauge readings, fuel-system component corrosion, fuel-system icing, and more frequent replacement of filters. Any water found in tank bottoms must be subtracted from the total innage to prevent overstatement of actual inventory.

To determine the water cut:

1. A gauge tape and bob are coated on one side with a thin, even film of water- finding paste.
2. The bob is then lowered through the gauging hatch until the tip of the bob barely touches the bottom of the tank. The product cut and the water cut are usually taken simultaneously using the same tape and bob.
3. Approximately 10 seconds reaction time is normally allowed for gasoline and kerosene base products and 30 to 60 seconds for heavier products.
4. The distance from the tip of the bob to the -cut is measured and recorded as -water innage.
5. Water checks must be made daily on working tanks and monthly on non-working tanks or each time a tank is gauged, whichever occurs first.

4.5.6 Gauging Equipment

The following equipment is required to accurately gauge fuel tanks:

- Innage Tape and Bob 75inch
- Innage Tape and Bob 50'
- Innage Tape and Bob 25'
- Water Indicating
- Water Indicating Paste
- Fuel Indicating Paste
- Cup Case Thermometer

4.5.7 Gauging Safety Procedures

When gauging a tank:

- Two people will always gauge tanks together.
- Gauge through the gauge hatch only and hold open no longer than necessary to obtain gauge.
- Do not open the gauge hatch until you have rested long enough to restore breathing to normal.

- Avoid inhaling tank vapors. Always stand to the windward side of an open hatch. Use a gas mask if conditions warrant.
- Do not descend upon the roof of a floating roof tank unless in sight of a second person stationed at the top of the stairway.
- To eliminate slipping and falling hazards:
- Avoid oil spills on tank platforms and stairways. If a spill occurs, clean it up immediately.
- Remove any broken bottles from walkways or tank stairways and place in trash containers.
- On tanks having ladders, face the ladder when using it. Keep both hands free when using ladders and avoid carrying any object that will interfere with their use.
- To avoid ignition hazards:
- Ground your body and the gauge tape by touching the stair rail or tank shell with your bare hand and with the tape reel when approaching the top of tank and before opening the gauge hatch.
- Keep the gauge tape in contact with the tank throughout the gauging operation.
- Do not gauge tanks that are in a state of extreme agitation.
- Remove any oily rags from the tank roofs to covered metal receptacles.

4.6 *Temperature Measurements*

Temperature measurements are taken almost without exception whenever gauges are taken for accounting purposes, to determine inventory on hand, product received, or product delivered. Petroleum products expand and contract significantly depending on their temperature and API gravity.

To minimize the effects of volumetric change due to thermal differences at the point of loading and the point of delivery, all volumes are corrected from the observed temperature to their -corrected volume at 60 degrees F. A volume correction will be made on each individual bulk issue or receipt of petroleum product of 3,500 gallons or more. Current ASTM tables for the correction of API and volume to 60 degrees F will require using Table 5B, (API correction to 60 degrees F); and Table 6B, (Correction of volume to 60 degrees against API gravity at 60 degrees F). For further information, see Table 8 of ASTM-D1250 Petroleum Measurement Tables, Fundamentals of Petroleum, NAVEDTRA 10883-B Chapter 6, and NAVSUP Manual, Volume II. A standard cup thermometer, 0 degrees to 150 degrees Fahrenheit range, marked to 1 degree Fahrenheit divisions on the glass, with an open metal oil cup of about 100cc capacity surrounding the bulb will be used. For heavy fuel oil or when accurate results are wanted more quickly in a tank that is not approximately the same temperature throughout, a special trap thermometer should be used.

The time required for a thermometer to reach equilibrium in fuel oil is considerable and varies greatly with conditions. It will seldom be under five minutes and may be 20 minutes. The thermometer should be withdrawn quickly and read immediately. A second person will witness the reading, and a recording will be made in the tank farm gauge book.

The number of temperature measurements to be taken is a compromise between ideal accuracy and practicality and is determined by the depth of the petroleum involved. Table 3-5 cites the requirements for the number of measurements required based on the size of the tank.

Table 4-2, Thermometer Depths in Large Tanks		
Depth	No. of measurements	Where taken
Less than 10'	1	Center of oil
10' and less than 15'	2	3' from bottom 3' below surface
15' and less than 20'	3	3' from bottom Middle of oil 3' below surface
20' and over	3	5' from bottom Middle of oil 5' below surface

When taking multiple temperature readings, proceed as follows:

1. Lower the thermometers into the oil at the appropriate levels in accordance with Table 3-5. Allow all thermometers enough time to have the temperatures equalize.
2. Withdraw as rapidly as possible and read each thermometer to nearest degree.
3. After the readings are taken, compute an average and record the average temperature in the gauge book.
4. Basing issue volume on tank temperature is by no means necessarily correct if the pipelines are long and at different temperatures from the tank, and the issues relatively small in proportion to the line volume.
5. To avoid ignition hazards:
6. Ground your body and the thermometer chains by touching the stair rail or the tank shell with your bare hand and with the chains when approaching the top of tank and before opening the gauge hatch.
7. The chains attached to all thermometers will be of non-sparking material and will be constantly grounded with the side of the gauge hatch when taking temperature readings of aviation fuels.